Transportation Systems in Plants

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Transportation Systems in Plants

For Teachers:

Introduction

As with large, multicellular animals, many plants require efficient internal transportation of nutrients and other life-sustaining substances. Plants that grow upwards to compete for sunlight have some distance between their roots and their leaves. Transport systems provide the link between these separate but equally vital structures. This program takes a detailed look at how plants obtain nutrients, and the structures that have evolved to carry nutrients to where they are needed. The two reactants for photosynthesis are obtained at different places (roots and leaves), so how are these brought together? How do sugars and minerals get to all cells for growth and repair? These questions are answered by examining the functions of root hairs, xylem and phloem. The program features vibrant footage of flora and fauna, graphical representations of plant structures, on-screen input from highly qualified plant scientists, and reference to real-life plant species. The interviewees are David Cantrill, Chief Botanist and Director National Herbarium Victoria and Royal Botanic Gardens Melbourne, and Richard Rowe, Horticulturalist at Melbourne Zoo.

Program Timeline

00:00:00 Introduction
00:01:31 What is a Transport System?
00:06:38 How do Plants Get Their Nutrient?
00:11:06 Root Hairs
00:14:19 Xylem Transport
00:18:39 Phloem Transport
00:21:35 Conclusion
00:22:17 Credits
00:22:54 End Program

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Student Worksheet:

Before Viewing the Program

1. Discuss the main reasons why large, multicellular animals need internal transport systems such as a circulatory system.

2. Discuss how plants with roots and leaves obtain their nutrients. Include the word equation for photosynthesis and explain where in a plant each reactant or product would be absorbed, stored or released.

3. Considering the fact that plants do not have blood, discuss why you think some plants may need internal transport systems.
While Viewing the Program

1. What is the primary function of each of the following structures in animals?
   a) The heart

   ____________________________________________

   ____________________________________________

   b) The lungs

   ____________________________________________

   ____________________________________________

2. State the four things that plants need from their environment to survive.

   ____________________________________________

   ____________________________________________

   ____________________________________________

   ____________________________________________

3. Complete the following sentences:
   a) Plants photosynthesise in their __________________. That’s where they have
      __________________ which can use the sun’s energy to fix __________________.
   b) Photosynthesis requires __________________ to stay alive, plants need to carry
      __________________ and __________________ from the soil all the way up to the leaves.

4. Name two types of simple plants that absorb water and nutrients by diffusion and must therefore
   inhabit moist environments.

   ____________________________________________

   ____________________________________________

5. Name the three most important functional parts of a vascular plant.

   ____________________________________________

   ____________________________________________

   ____________________________________________

6. What are the two important functions of roots?

   ____________________________________________

   ____________________________________________
7. State the important function of:
   a) Stems
   b) Leaves

8. Explain why a plant would need to transport sugars from the leaves to other parts of the plant.

9. Name the parts of a vascular plant that perform the following functions:
   a) Transport water and nutrients from the roots to the leaves
   b) Transport sugars and other photosynthetic products all around the plant

10. How do root hairs help to improve water uptake in a plant’s root system?

11. Name the process by which water is drawn through the xylem from the roots to the leaves, which is similar to sucking on a straw.

12. Xylem and phloem tubes are made from cells joined end-to-end. State which of these tubes are made from:
   a) Dead cells
   b) Living cells

13. State the term that describes the transport of sugars etc in the phloem.
After Viewing the Program

1. In groups, complete the experiment on transportation in plants from the “Transportation in plants” web link below.
   
   [http://www.iit.edu/~smile/bi9703.html](http://www.iit.edu/~smile/bi9703.html)

2. As a class, design and role play the transport system in plants, with students representing: root hairs, xylem, phloem, water molecules, leaves, sugars etc.

3. In small groups, research the functional details of either: roots, xylem, phloem or leaves and present your findings to the class via a PowerPoint presentation.

4. Using basic materials (at home or at school) design, construct and label a 3-D model of a vascular plant, showing the transport systems.
Suggested Student Responses

While Viewing the Program

1. What is the primary function of each of the following structures in animals?
   
a) The heart
   To assist in the transport of blood around the body. This efficiently provides oxygen and
   nutrients to cells as well as removing waste products.

   b) The lungs
   To facilitate the efficient exchange of gases (oxygen and carbon dioxide) between the air
   and the blood.

2. State the four things that plants need from their environment to survive.
   Water
   Carbon dioxide
   Sunlight
   Nutrients

3. Complete the following sentences:
   
a) Plants photosynthesise in their leaves. That’s where they have chloroplasts which can use the
   sun’s energy to fix carbon.

   b) Photosynthesis requires water to stay alive; plants need to carry water and nutrients from the
   soil all the way up to the leaves.

4. Name two types of simple plants that absorb water and nutrients by diffusion and must therefore
   inhabit moist environments.
   Mosses
   Liverworts

5. Name the three most important functional parts of a vascular plant.
   Roots
   Stems
   Leaves

6. What are the two important functions of roots?
   To anchor the plant in the soil
   To absorb water

7. State the important function of:
   
a) Stems
   To transport water and sugars via xylem and phloem tubes.

   b) Leaves
   To carry out photosynthesis to make sugars for energy.

8. Explain why a plant would need to transport sugars from the leaves to other parts of the plant.
   To provide energy for physiological functions such as growth, repair, reproduction, transport etc.
Transportation Systems in Plants

9. Name the parts of a vascular plant that perform the following functions:

   a) Transport water and nutrients from the roots to the leaves
      Xylem

   b) Transport sugars and other photosynthetic products all around the plant
      Phloem

10. How do root hairs help to improve water uptake in a plant’s root system?
    By increasing the surface area of the roots

11. Name the process by which water is drawn through the xylem from the roots to the leaves, which is similar to sucking on a straw.
    Transpiration

12. Xylem and phloem tubes are made from cells joined end-to-end. State which of these tubes are made from:

    a) Dead cells
       Xylem

    b) Living cells
       Phloem

13. State the term that describes the transport of sugars etc in the phloem.
    Translocation